



2.

가

가

1.

1995 1 2004 6 2

15 3.

1 가 가 18

, 20 가 25%

11 (61.1%), 가 7 (38.9%)

10.2 ( ; 2~15 )

42.5 ( ; 12~120 ) 2

5

, 12

가

(Fig. 1).



**Fig. 1.** Pathologic femur fracture secondary to monostotic fibrous dysplasia in 12 year-old boy. **(A)** Preoperative AP radiograph shows proximal femur fracture secondary to fibrous dysplasia. **(B)** Immediate postoperative radiograph shows calcium sulfate graft after curettage of fibrous dysplasia. **(C)** After 12 months, fracture was healed. **(D)** After metal removal, there were no recurrence of fibrous dysplasia.



**Fig. 2.** Pathologic femur fracture secondary to polyostotic fibrous dysplasia in 10 year-old girl. (A) Both hip AP radiograph shows proximal femur fracture treated with cast immobilization. (B) After cast immobilization, fracture was healed. (C) After 10 years, shepherd's crook deformity developed. (D) Postoperative shows deformity corrected by osteotomy and IM nailing.

18 (90.0%),  
2 (10.0%)

1  
(Table 1). 2.

11.12 ( ; 8~16 )

1. , 3.  
14 (70.0%), 3  
(15.0%), 3 (15.0%) 7  
7 2  
9 (45.0%), 4  
(20.0%), 4 (20.0%), 1 가 가  
2 (10.0%), 1 (5.0%)

**Table 1.** Summary of cases

Case	*Sex/Age	†Bone Tumors	Fracture sites	‡Treatment	Time to union (weeks)
1	M / 5	Monostotic FD	Proximal	Cast	12
2	M / 12	Monostotic FD	Proximal	Curettage & BG ORIF with CHS	12
3	M / 15	Polyostotic FD	Shaft	Cast	12
4	F / 10	Polyostotic FD	Proximal	Cast	12
5	F / 12	Polyostotic FD	Proximal	Cast	10
6	M / 10	Polyostotic FD	Shaft	Cast	12
7	M / 11	Polyostotic FD	Proximal	Cast	8
8	F / 10	Polyostotic FD	Proximal	Cast	12
9	M / 12	Polyostotic FD	Proximal	Cast	8
10	M / 11	SBC	Shaft	Curettage & BG IM nail	12
11	M / 9	SBC	Distal	Curettage & BG ORIF with Plate	12
12	M / 5	SBC	Proximal	Curettage & BG ORIF with ABP	8
13	M / 10	SBC	Proximal	Curettage & BG Cast	12
14	F / 15	ABC	Distal	Tumor resection & Ilizarov	12
15	F / 12	ABC	Proximal	Curettage & BG ORIF with CHS	12
16	F / 14	ABC	Proximal	Curettage & BG ORIF with CHS	12
17	M / 11	ABC	Proximal	Curettage & BG ORIF with Plate	12
18	F / 2	NOF	Proximal	Cast	8
19	F / 15	NOF	Distal	Curettage & BG ORIF with Plate	12
20	F / 3	EG	Proximal	Cast	8

\*M, Male ; F, Female ; †FD, Fibrous dysplasia; SBC, Simple bone cyst; ABC, Aneurysmal bone cyst; NOF, Nonossifying fibroma; EG, Eosinophilic granuloma ‡ORIF, Open reduction internal fixation; CHS, Compression hip screw; IM, Intramedullary; BG, Bone graft; ABP, Angled blade plate.

4.

6,8)

1  
. 7

8)  
Dormans 5)

4 1

2 3

4

Dormans

1

4,12)

가

1,5,12)

12). Hipp 9)

2

15  
가

가 10,11)

Dormans

1

2

3)

5,13)

Dormans

2

, demineralized bone matrix, tricalcium phosphate, hydroxyapatite, calcium sulfate

5) 4

가 가 가

2,14) Enneking 7) 15

14

high-speed bur

REFERENCES

- 1) **Arata MA, Peterson HA and Dahlin DC:** Pathologic fractures through non-ossifying fibromas: Review of the Mayo Clinic experience. *J Bone Joint Surg*, 63-A:980-998, 1981.
- 2) **Bruce TR:** Bone graft alternatives in the treatment of benign bone tumors. *AAOS Instr Course Lect*, 54:505-512, 2005.
- 3) **Casadei R, Ruggieri P, Ferraro A and Mercuri M:** Indications for the treatment of pathologic fracture in tumors of bone. *Chir Organi Mov*, 81:21-30, 1996.
- 4) **DeLee J:** Fractures and dislocations of the hip. IN Rockwood C, Green D, Bucholz R, Heckman J(eds). Rockwood and Green 's Fractures in the adult Philadelphia, *Lippincott-Raven*, 1711-1714, 1996.
- 5) **Dormans JP and Flynn JM:** Fractures through bone cysts: Unicameral bone cyst, aneurysmal bone cysts, fibrous cortical defects and nonossifying fibromas. *AAOS Instr Course Lect*, 51:457-567, 2002.
- 6) **Dupoirieux L, Costes V, Jammet P et al:** Experimental study on demineralized bone matrix (DBM) and coral as bone graft substitutes in maxillofacial surgery. *Int J Oral Maxillofac Surg*, 23:395-398, 1994.
- 7) **Ennekin WF and Gearen PF:** Fibrous dysplasia of the femoral neck: Treatment by cortical bone-grafting. *J Bone Joint Surg*, 68-A:1415-1422, 1986.
- 8) **Gibbs CP, Lewis VO and Peabody T:** Beyond bone grafting: Techniques in the surgical management of benign bone tumors. *AAOS Instr Course Lect*, 54:497-504, 2005.
- 9) **Hipp JA, Springfield DS and Hayes WC:** Predicting pathologic fracture risk in the management of metastatic bone defects. *Clin Orthop*, 120-135, 1995.
- 10) **Kaelin AJ and MacEwen GD:** Unicameral bone cysts. Natural history and the risk of fracture. *Int Orthop*, 13:275-282, 1989.
- 11) **Nakamura T, Takagi KD, Kitagawa T, et al:** Microdensity of solitary bone cysts after steroid injection *J Pediatr Orthop*, 8:556-558, 1988.
- 12) **Ortiz EO, Isler MH, Navia JE and Canosa R:** Pathologic fractures in children. *Cl in Orthop*, 432:116-126, 2005.
- 13) **Roposch A, Saraph V and Linhart WE:** Flexible

가 1

1

3 가

가

Wai 14)

가

가 가

intramedullary nailing for the treatment of unicameral bone cysts in long bones. *J Bone Joint Surg*, 82-A:1447-1453, 2000.

14) Wai EK, Davis AM, Griffin A, Bell RS and

Wunder JS: Pathologic fractures of the proximal femur secondary to benign bone tumors. *Clin Orthop*, 393:279-286, 2001.

## Abstract

### Femur Fractures Associated with Benign Bone Tumors in Children

Sung Taek Jung, M.D., Byung Soo Kim, M.D., Eun Sun Moon M.D.,  
Keun Bae Lee, M.D., Hyoung Yeon Seo, M.D.

*Department of Orthopedic Surgery, Chonnam National University Medical School, Gwangju, Korea*

**Purpose:** We evaluate the results of treatment of pathologic femur fractures secondary to bone tumors in children.

**Materials and Methods:** Between January 1995 and June 2004, 18 patients(20 cases) were evaluated. Their mean age of the first episode of fracture was 10.2 years and mean follow-up period is 42.5 months. Primary bone tumors, the location of fracture, time to union and complications were evaluated.

**Results:** Fractures occurred at proximal portion in 14 cases, shaft 3 cases and distal portion 3 cases. The bone tumors causing pathologic fracture were fibrous dysplasia(9 cases), simple bone cyst(4 cases), aneurysmal bone cyst(4 cases), nonossifying fibroma(2 cases) and eosinophilic granuloma(1 case). In the treatment for fractures, cast was in 11 cases, internal fixation 8 cases and external fixation in 1 case. In the treatment for tumors, observation was in 11 cases, curettage & bone graft in 8 cases and resection in 1 case. In polyostotic fibrous dysplasia, all cases were treated by cast initially but deformity developed in all cases. Fracture prevention and deformity correction were obtained with intramedullary nailing.

**Conclusion:** Adequate choice of treatment of bone tumor and fracture will result in good prognosis.

**Key Words:** Pathologic femur fracture, Bone tumor, Children

#### Address reprint requests to

Byung-Soo Kim, M.D.

Department of Orthopaedic Surgery Chonnam National University Hospital

8 Hak Dong, Gwangju, 501-757, Korea

TEL: 82-62-227-1640, Fax: 82-62-225-7794, E-mail: herokimos@hanmail.net